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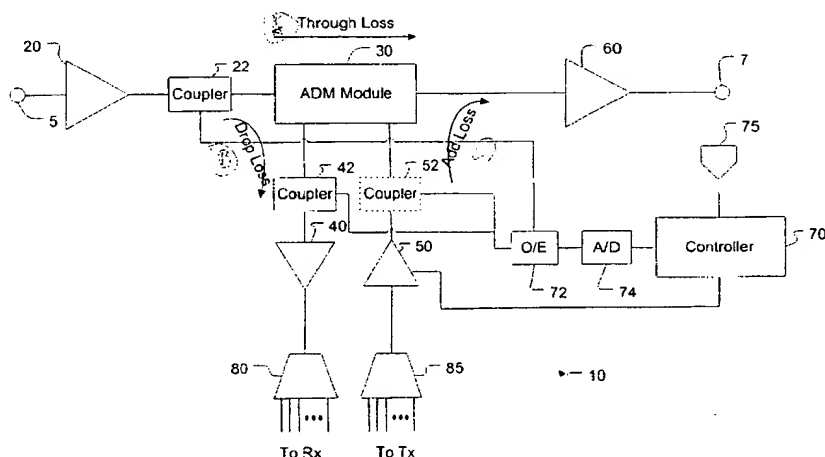
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- (74) Agent: **CAMMARATA, Michael, R.**; Ciena Corporation, Legal Department, 1201 Winterson Road, Linthicum, MD 21090 (US).
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- (71) Applicant: **CIENA CORPORATION** [US/US]; Legal Department, 1201 Winterson Road, Linthicum, MD 21090 (US).
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- (72) Inventors: **DEGRANGE, James, E., Jr.**; 8104 Woodbine Court, Glen Burnie, MD 21061-6305 (US). **SRIDHAR, Balakrishnan**; 2845 Carroll Wind Drive, Ellicott City, MD 21043 (US).
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: POWER BALANCED OPTICAL ADD/DROP MULTIPLEXER AND POWER BALANCING METHODS THEREFORE



(57) Abstract: To improve a power balance of an optical add/drop multiplexer, an add amplifier is optically coupled to an add path of an optical add/drop module. A through loss associated with a signal passing through the add/drop module, a drop loss associated with a signal travelling a drop path of the add/drop module, and an add loss associated with a signal travelling an add path of the add/drop module are known or otherwise calibrated values. A dropped channel power measurement is used in conjunction with the through loss, add loss, drop loss, number of dropped channels and number of added channels to determine an add path amplification value. The gain of the add amplifier is controlled according to add path amplification value so that the power level of the added channel(s) substantially matches the power level of the WDM signal output from the add/drop multiplexer. Furthermore, the gain profile of the add amplifier preferably matches a gain profile of a signal input to the add/drop module. In this way, the power level and gain profile of the added channel(s) can be controlled to match the power level and gain profile of the signal passing through the add/drop module.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 02/03489

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04J14/02 H04B10/17 H04B10/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04J H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	W0 97 06616 A (JONES K P ET ALL; STC SUBMARINE SYSTEMS LTD) 20 February 1997 (1997-02-20) abstract page 5, line 2 - line 12 page 6, line 5 -page 7, line 7 ---	1-18, 22-26
A	EP 1 035 680 A (MARCONI COMM LTD) 13 September 2000 (2000-09-13) abstract paragraph [0003] paragraph [0011] - paragraph [0021] ---	1-18, 22-26
E	US 2002 105 694 A1 (DEGRANGE JAMES E ET AL) 8 August 2002 (2002-08-08) the whole document --- -/--	1-18, 22-26

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search

27 June 2003

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18.09.03

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 02/03489

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	US 2002 105 695 A1 (DEGRANGE JAMES E ET AL) 8 August 2002 (2002-08-08) the whole document -----	1-18, 22-26

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internat Application No
PCT/US 02/03489

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9706616 A	20-02-1997	CA 2225469 A	20-02-1997
		CN 1197563 A	28-10-1998
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 02/03489

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-18, 22-26

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

1. Claims: 1-18,22-26

Optical communications apparatus for power balancing a WDM signal in which an add path amplification value is based on the number of channels to be added or to be dropped, and a corresponding method.

2. Claims: 19-21,27-32

Optical communications apparatus for power balancing a WDM in which an add path amplification value is based on the input power measurement, and a corresponding method.